



ELECTRIC FENCING FOR BLACK BEARS **



Electric fencing has proven effective in deterring bears from landfills, apiaries, cabins, and other high-value properties. Fencing, however, is a relatively expensive abatement measure. Consider the extent, duration, and expense of damage when developing a prevention program.

Numerous fence designs have been used with varying degrees of success. Electric fence chargers increase effectiveness. Electric fences must deliver an effective shock to repel bears. Bears can be lured into licking or sniffing the wire by attaching attractants (salmon or tuna tins and bacon rinds) to the fence. Depending on the amount of bear pressure, use an electric polytape portable fence or a permanent fence. An innovative technique for beekeepers is to place hives on a fenced (three-strand electric) flatbed trailer (8 feet x 40 feet). Though expensive, this method makes hives less vulnerable to bear damage and makes moving them very easy.

Materials. Do not buy cheap materials to reduce costs. This will only reduce the effectiveness and life span of the fence. We recommend using:

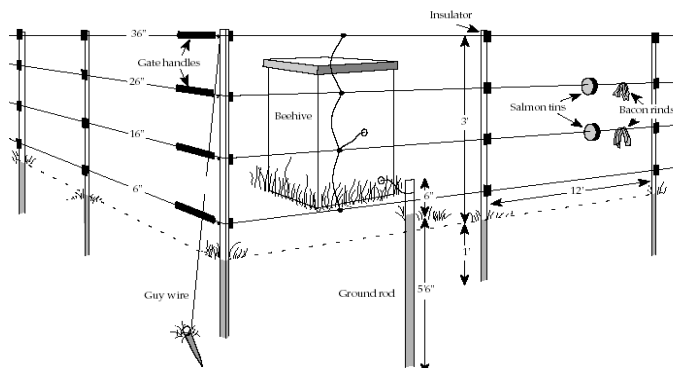
- (1) Round fiberglass or treated wood posts.
- (2) High-quality galvanized wire and steel components. For high-tensile fences, use 11- to 14-gauge wire (minimum tensile strength of 200,000 pounds and a minimum breaking strength of 1,800 pounds, tension springs, and in-line tensioners.
- (3) Compression sleeves for splicing wires and making electrical connections.
- (4) Lightning arresters and diverters to protect chargers.
- (5) High-quality fence chargers. To energize the fences, use a 110-volt outlet or 12-volt deep cell (marine) battery connected to a high-output fence charger. Chargers must be approved by Underwriters Laboratories (UL) or the Canadian Standards Association (CSA). We highly recommend 110-volt chargers. Six and 12-volt chargers require battery recharging every 2 to 4 weeks. Use solar panels in remote areas to charge batteries continuously. For high-tensile fences, use high-voltage, low-impedance chargers only (3,000 to 5,000 volts and current pulse duration of at most 1/1,000 second). Place the fence charger and battery in a case or empty beehive to protect them against weather and theft.
- (6) Gates. There is no universal gate design because of the many different fence types. Gates should be electrified, well insulated, and practical for the type of farming operation. Gates range from single strands of electrified wire with gate handles to electrified panel or tubular gates.

Fence Construction. Fences must be properly constructed--do not deviate from fence construction guidelines.

- (1) Prepare fence lines before construction. It is easier and less expensive to install and maintain fences on clear, level runs. Minimize corners to increase strength and reduce costs.
- (2) Ensure that the electrical system is well grounded at the fence charger and every 1/2 mile of fence line. To ground high-tensile fences, drive four to six ground rods 5 to 6 feet deep and 6 feet apart. Connect the ground post of the fence charger and the negative (-) wires of the fence to the grounding rod with a wire and ground clamp. Grounding may be increased, especially in dry, sandy soil, by laying grounded chicken wire around the outside perimeter of the electric fence.
- (3) A positive-negative fence is especially useful with dry or frozen ground. A fence with all positive (hot) wires may be advantageous under general crop and soil moisture conditions. Use connectors to ensure good contact. Connect the positive fence terminal to the fence with a short piece of fence wire.
- (4) Rigid brace assemblies—corners, ends, and gates—make up the backbone of all high-tensile fence systems. They must be entirely rigid, constructed of the best materials, and strictly conform to design guidelines. The single-span brace assembly is the basis of all high-tensile strainer assemblies, regardless of location in the fence or fence design. This basic design is then modified to create double-“H” braces, swing corners, and gate ends.
- (5) Allow wires to slide freely through insulators on fence posts. Fence flexibility is necessary to endure frequent temperature changes, deer hits, and obstructions.
- (6) Identify an electric fence with warning signs.

Maintenance. Regular inspection and maintenance are necessary to ensure the effective operation and longevity of most fences.

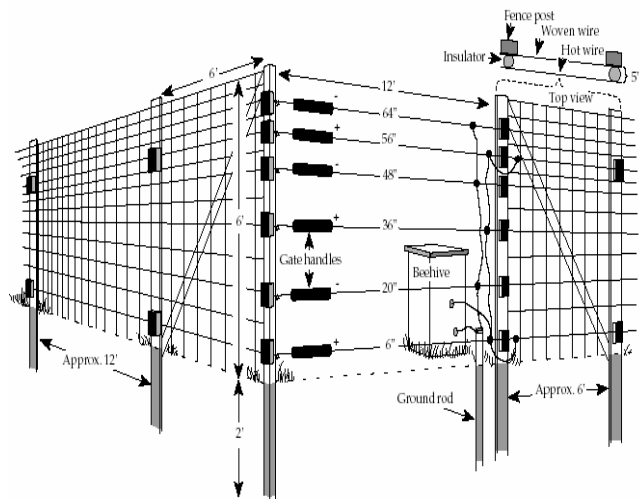
- (1) Control vegetation near fences by mowing or applying herbicides to avoid excessive fence grounding by weeds.
- (2) On slopes or highly erodible soils, maintain a good sod cover beneath fences to avoid fence line erosion.
- (3) Always keep the fence charger on. Check the fence voltage weekly with a voltmeter. Maintain at least 3,000 volts at the furthest distance from the fence charger. Always recharge the batteries during the day so that the fence is energized at night.
- (4) To protect against voltage loss, keep the battery and fence charger dry and their connections free of corrosion. Disconnect the lower wires if they are covered by snow. Make certain all connections are secure and check for faulty insulators (arcing between wire and post).
- (5) Each month, check the fence tension and replace baits with new salmon tins and bacon rinds.
- (6) In late fall and early summer, adjust the fence tension (150 to 250 pounds) for high-tensile fences.



Polytape portable electric fence. One person can easily and quickly install this fence. It is economical and dependable for low to moderate bear pressures. The fence consists of four strands of electric polytape that are attached to posts with insulators. Various forms of polytape or polywire, such as Visible Grazing Systems® (VGS), Baygard®, and Turbo-tape® are very strong and portable. The cost per fence (33 x 33 feet) is about \$200. (~ \$1.50/linear ft)

- 1 200-yard roll of polytape
- 12 4-foot fence rods (5/16-inch diameter)
- 48 Insulators or clips
- 4 Gate handles
- 1 12-volt fence charger
- 1 12-volt deep cycle battery
- Herbicides

To install: Drive in four corner posts 1 foot deep and attach a guy wire. Clip vegetation in a 15-inch-wide strip under the fence and apply herbicide. Attach insulators on the inside of corner posts and stretch the electro-plastic wire from the four posts at intervals of 6, 16, 26, and 36 inches from ground level. Hand tighten the polytape and join the ends with four square knots. Drive in the remaining posts at 12-foot intervals, attach insulators (on the outside of line posts), and insert polytape.



Woven-wire permanent electric fence. This fence, best used under high bear pressure, is the most durable and expensive barrier. Two people can install it in 8 hours. The fence consists of heavy, 5-foot woven wire, supported by wooden posts, ringed by two additional electrified wires. Cost per fence (33 x 33 feet) is about \$400. (~ \$3.00/linear ft)

- 1 50-yard roll of 6-inch square mesh, 5-foot woven wire
- 1 150-yard roll of high-tensile (14-gauge) smooth wire
- 24 8-foot treated wooden posts
- 40 Porcelain strain-insulators (screw-in types)
- 1 2-pound box of 1 1/2-inch fence staples
- 6 gate handles
- 1 12-volt fence charger
- 1 12-volt deep cycle battery
- Herbicides

To install: Set posts 6 to 12 feet apart in 2-foot-deep holes. Align four corner posts at 5° angles from the vertical. Brace corner and gate posts from the inside with posts set at 45° angles. Clip a 15-inch-wide strip clear of vegetation under the fence and apply herbicide. Place one length of welded wire vertically into position and staple the end to a corner post. Pull the entire length of wire taut with a vehicle and staple the welded wire to the line posts. Continue until all sides, except the gate opening, are fenced. Fasten two strands of high-tensile wire to insulators positioned 5 inches away from the welded wire, at intervals of 6 and 56 inches above ground level. For a 12-foot gate opening, attach three strands of high-tensile wire to insulators on the gateposts. Space the wires at intervals of 6, 36, and 56 inches above ground level. Connect them to the two strands previously strung around the fence. These wires will be connected to the positive fence charger terminal. Attach three more wires to gatepost insulators at intervals of 20, 48, and 64 inches above ground level. These three wires will be connected together and to the ground rod. Fit insulated gate handles to the free ends of all six gate wires.

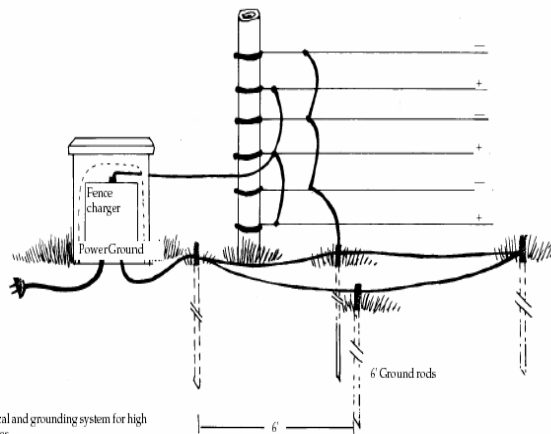
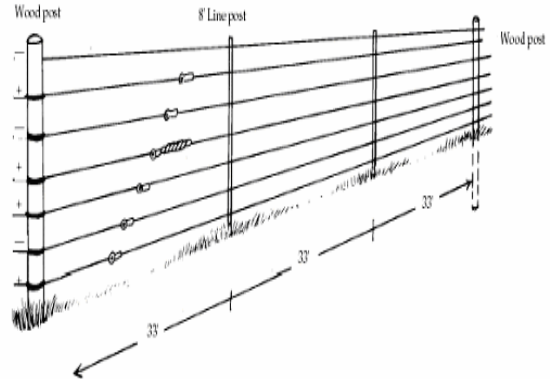


Fig. 13. Electrical and grounding system for high tensile fences.



High-tensile permanent electric fence. High-tensile fencing can provide year-round protection. Many designs are available to meet specific needs. All require strict adherence to construction guidelines concerning rigid corner assemblies and fence configurations. Frequent inspection and maintenance are required. High-tensile fences are expected to last 20 to 30 years. Vertical fences are effective at protecting large areas from moderate to high pressures. There are a wide variety of fence materials, wire spacings, and specific designs you can use. Barbed wire (3-4 inches between barbs) will help provide more electric contact through the insulating fur than will smooth wire. Costs, excluding labor, range from \$0.75 to \$1.50 per linear foot.

To install: Install rigid corner assemblies where necessary. String a 12 1/2-gauge high-tensile wire around the corner assemblies and apply light tension. Set 8-foot line posts along. Attach a wire to insulators at 4-6 inches above ground level and apply 150 to 250 pounds of tension. Attach the remaining wires to insulators at a 10-inch spacing and apply 150 to 250 pounds of tension. Connect the second, fourth, fifth, and seventh wires from the top, to the positive (+) post of a well-grounded, low-impedance fence charger. Connect the top, third, and sixth wires directly to ground. The top wire should be negative for lightning protection. Clear and maintain a 6- to 12-foot open area outside the fence. Maintenance includes weekly fence inspection and voltage checks.

** Adapted from Hygnstrom, S. E., R. M. Timm, and G. E. Larson. 1994. Prevention and control of wildlife damage. University of Nebraska Cooperative Extension Service, US Department of Agriculture, Animal and Plant Health Inspection Service.